



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2016/2017**

TERBUKA

COURSE : ELECTRICAL POWER
TRANSMISSION AND
DISTRIBUTION

COURSE CODE : BEF 34603

PROGRAMME : BEV

EXAMINATION DATE : DECEMBER 2016 / JANUARY
2017

DURATION : 3 HOURS

INSTRUCTION : ANSWER ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF FIVE (5) PAGES

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- Q1** (a) A 50 km long transmission line supplies a load of 5 MVA at 0.8 p.f lagging at 33 kV. The efficiency of transmission is 90% and the specific resistance of aluminium is $2.85 \times 10^{-8} \Omega\text{m}$. Determine the volume of aluminium conductor required for the line when:
- (i) Single phase, 2-wire system is used. (8 marks)
- (ii) Three phase, 3-wire system is used. (5 marks)
- (b) From the result in **Q1(a)(i)** and **Q1a(ii)**, recommend the best system that can be used with justification. (4 marks)
- (c) Investigate the relationship between temperature, tension and sag. (3 marks)
- Q2** (a) An insulator string for 66 kV line has 4 discs. The shunt capacitance between each joint and metal work is 10% of the capacitance of each disc. Determine:
- (i) The voltage across the different discs (8 marks)
- (ii) The string efficiency. (2 marks)
- (b) Skin effect is caused by magnetic flux set up due to alternating current inside the conductor. Explain the skin effect and discuss this phenomenon in d.c system. (4 marks)
- (c) A 3-phase, 50 Hz, 275 kV overhead line has conductors placed as shown in **Figure Q2(c)**. The conductor diameter is 3 cm. Assuming the line length is 150 km and neglecting the effect of ground, determine:
- (i) Line to neutral capacitance per km. (4 marks)
- (ii) The charging current per phase per km when the line is completely transposed. (2 marks)

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Q3 (a) Draw and label the equivalent circuit of a medium length line for nominal π model. (2 marks)

(b) A 220 kV, 200 MVA and 50 Hz, three-phase transmission line is 150 km long completely transposed transmission line has the following positive-sequence impedance and admittance:

$$\begin{aligned} r &= 16.5 \Omega \\ x &= 0.90 \Omega/\text{km} \\ y &= 5.0 \times 10^{-6} \text{ S/km} \end{aligned}$$

The voltage at the receiving end of the transmission line is 200 kV, calculate:

(i) The value of sending end voltage if the line supplying rated voltage and rated apparent power at 0.85 PF lagging. (7 marks)

(ii) The efficiency of the line. (4 marks)

(iii) If the line supplies change to 200 MVA load at unity power factor. Compare and explain the efficiency of the transmission line with the results **Q3(b)(ii)**. (7 marks)

Q4 (a) Power factor of an AC electrical power system is defined as the ratio of the real power flowing to the load to the apparent power in the circuit. Briefly explain **three (3)** the causes of low power factor. (6 marks)

(b) A single phase motor connected to 400 V, 50 Hz supply takes 42.2 amperes at a power factor of 0.72 lagging.

(i) Sketch the circuit and phasor diagrams with appropriate labels when the capacitance is connected in parallel with the motor in order to increase the power factor. (4 marks)

(ii) Propose the capacitance required to raise the power factor to 0.90 lagging. (8 marks)

(c) Compare the relationship of power factor with the voltage regulation of motor if the power factor is less than 0.85 lagging. (2 marks)

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- Q5** (a) Construct and explain briefly the **three (3)** primary distribution lines circuits. (6 marks)
- (b) A single phase distributor one km long has resistance and reactance per conductor of 0.1 and 0.15 ohm respectively. At the far end, the voltage $V_B = 200V$ and the current is 100A at a p.f. of 0.8 lagging. At mid-point M of the distributor, a current of 100A is tapped at a p.f. of 0.6 lagging with reference to the voltage V_M at the mid-point. Calculate
- (i) The voltage at mid-point. (4 marks)
- (ii) The sending end voltage. (5 marks)
- (iii) The phase angle between V_A and V_B . (2 marks)
- (c) Oil-filled cables are can divided into three types which are single-core conductor channel, single-core sheath channel and three-core filler-space channels. Compare the structure of these three types of cable with appropriate label. (3 marks)

- END OF QUESTIONS -

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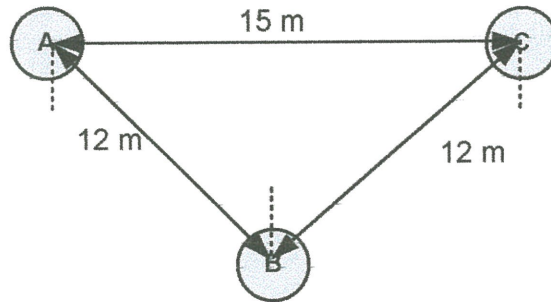
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**Figure Q2(C)****TERBUKA**
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